the two basins. While in the Atlantic it seems certain that the temperature sinks gradually, though very slightly, for the last thousand fathoms to the bottom, it appears that in the Pacific the minimum temperature of 1°·7 C. is reached at a depth not greater than 1,400 fathoms, and that from that depth to the bottom the temperature is the same.

The soundings from Yokohama to Honolulu are remarkably uniform in depth, the twenty-two soundings on one line which are unaffected by the neighbourhood of land giving an average of 2,858 fathoms. The nature of the bottom is also very uniform; and, according to the nomenclature which we have adopted, it is in each case noted on the chart as "red clay." It is usually, however, somewhat greyer in colour than the typical "red clay," and contains a large proportion of the tests of siliceous organisms, a proportion which increases with increasing depth, and a considerable proportion of pumice in different states of comminution and decomposition. The clay contains scarcely a trace of carbonate of lime, although the surface swarms with ooze-forming foraminifera. In some cases the trawl came up half full of large lumps of pumice, which seemed to have been drifted about till they were water-logged, and to be softening and becoming decomposed; these pieces of decomposing pumice were often coated and pervaded throughout with oxide of manganese. Over the shale area the red clay was full of concretions, consisting mainly of peroxide of manganese, round, oval, or mammillated and very irregular, varying in size from a grain of mustard-seed to a large potato. When these concretions are broken up, they are found to consist of concentric layers having a radiating fibrous arrangement, and usually starting from a nucleus consisting of some foreign body, such as a piece of pumice, a shark's tooth, or a fragment of any organism, as for instance in one case a piece of a Hexactinnelid sponge, of the genus *Aphrocallistes*, which was preserved as a very beautiful fossil in the centre. The concretions appear to form losse among the soft clay; the singular point is the amount of this manganese formation, and the vast area which it covers.

We were particularly successful during this cruise in getting good samples of the fauna from great depths; and we found that the fauna of the North Pacific at depths of from 2,000 to 3,000 fathoms, although not very abundant in species, is by no means meagre. For each of six dredgings and trawlings at depths greater than 2,000 fathoms, we found along with a few fishes a fair representation of all the larger invertebrate groups; and in one dredging, No. 253, at a depth of 3,125 fathoms, we took a small sponge, a species of *Cornularia*, an *Actinia*, an annelid in a tube, and a Bryozoon. We were again struck with the wonderful uniformity of the fauna at these depths; if not exactly the same species, very similar representatives of the same genera in all parts of the world. I am glad to be able to report that everything is going on in a satisfactory way in the departments under my charge.

ACOUSTIC CLOUDINESS

WHEN the weight and number of the guns in action are taken into account, the following extract from "My Experiences of the War between France and Germany," vol. ii. pp. 285-9, by Archibald Forbes, will probably be regarded as the most extraordinary instance of "acoustic cloudiness" hitherto recorded. The complete reversal of the optical and acoustical conditions on two succeeding days renders the case very perfect. I am indebted for the extract to the obliging kindness of Mr. James Kenward, of Birmingham.

"The morning of the 6th presented a remarkable contrast in every respect to that of the preceding day. The latter had been cold to the chilling of the marrow, and so thick that nothing was to be seen half a mile away. The former was clear, bright, and warm as a morning in the end of March. Yesterday the air was charged with sound; to-day there reigned the stillness of an Arcadia that knows not war. Men looked at each other in blank amazement. Had Paris, forts, big guns, bombardment, and the no-bombardment on the eastern side alike been spirited away? Had the French reply shut up our pretty Spandau toys in one day? Or, on the contrary, had those pieces of finished mechanism stove in the forts and batteries bodily? And if we were going up to Montmorency, should we see the white flag on the top of Montmartre in token that all was over? Men were reticent in expressing speculations, but at the corners of the straggling lanes of Margency I heard the words 'Capitulation,' 'Parlementaire,' muttered as the feldgensdarmes and the orderly-men gossiped in little groups. Making the best of my way to head-quarters, I found head-quarters in ignorance and suspense. Nobody could interpret this strange, ghostly silence. There had come from Versailles on the previous night a telegram stating that the King was well pleased with the results which the day's bombardment had achieved. So it was plain the silence was not on our part due to coercion. 'Negotiations, then?' I suggested to my friendly interlocutor. 'No, that cannot well be,' was the reply, 'since in that case we should have received instant instructions to silence our Maas Army batteries, and this has not been the case.' 'Are they firing, then?' I asked, for it might be that I had been struck with sudden deafness. 'No, it would seem not, I can hear nothing. The silence is a puzzler, but we are sure to hear all about it within a few hours.' Determining to anticipate by personal investigation the information which was kindly promised me, I rode off to the front of Montmorency, whence there lay spread before the eye the wide panorama of the north side of Paris. Still all was silent as the grave. There was the white foreground, the ice-bound river, and the St. Denis chimneys smoking lustily according to their wont. Neither from the east nor the west came there the slightest sound of firing. A slight haze-bank hung over Le Bourget, which might have been snow, fog, or the filmy smoke of a cannonade; but, if the latter, it must have surely been audible. There I found three mounted officers, and we had a little talk about the position. They inclined to the armistice-negotiations theory, more especially as they had not heard a single shot since morning. As we spoke, there came a white jet of smoke out of the grey side of La Briche. No sound; for all the noise it made it might have been an escape of steam. But in a second or two we did hear something—the close swish of the shell, and then the explosion about fifty yards to the right. La Briche could not resist the temptation of the group. 'No negotiations, then, that is certain,' was the remark as we broke up and went our several ways.

"This action of La Briche rather intensified the puzzle, because it seemed to knock away the only explanation. I could not go to the south, but I could visit the batteries about Pont Iblon, and get at the root of the matter.

. . . .

"I came on to Gonesse alone. What was my surprise to find all the German batteries from Gonesse to Sevran firing away vigorously! They had been at it since eight in the morning. In Gonesse I learned that the firing on the south side was believed to have recommenced at the same hour, and was certainly going on. Yet at Margency and Montmorency we could not hear a sound. It was all owing to the air; it was to-day as non-conducting of sound as it had been the reverse yesterday. Even in Gonesse we could not hear the guns that were thundering, so to speak, at our elbows."

The condition of things here so graphically described discloses a state of the atmosphere precisely similar to that existing at the South Foreland on the 3rd of July, 1873. There, as here, the belching of the smoke from

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the 18-pounder, the howitzer, and the mortar, resembled noiseless jets of steam, projected, "so to speak, at our elbows." JOHN TYNDALL

Royal Institution, Nov. 17

CHARLES BLACKER VIGNOLES, F.R.S.

THIS celebrated engineer died on the 17th instant at Hythe, at the age of eighty-three years. Although he won his fame mainly as an engineer, yet his services to science were of considerable importance. Mr. Vignoles was descended from an ancient French family which had taken refuge in England after the repeal of the Edict of Nantes. His father, Capt. Vignoles, was an officer in the 43rd Regiment of the Line, and his mother was a daughter of Dr. Charles Hutton, the celebrated mathematician and professor at the Royal Military Academy, Woolwich. When young Vignoles was only twelve months old, his father lost his life at the storming of Pointe-à-Pierre, Guadaloupe, when Sir Charles Grey, the commander of the British forces, gave the former a commission in the army. Thus his career has been an unprecedentedly long one. His grandfather, Dr. Hutton, undertook his education, and the pupil certainly turned out a credit to his teacher. For a short time before the conclusion of the great war which ended in 1815, Vignoles served under the Duke of Wellington on the Continent, and after visiting America about 1822, he returned to England and threw himself enthusiastically into the engineering profession. The railway movement was just then gathering strength, and Vignoles was associated with some of the earliest efforts to establish lines in this country. After the Liverpool and Manchester Railway Bill was thrown out of Parliament in 1824, he was, in 1825, selected by Messrs. Rennie to take charge of the new surveys which the Liverpool Committee ordered. From this time forward Vignoles was ever in the van of the railway movement, and had the foresight to predict, amid some incredulity and ridicule, to what gigantic results it would lead. In 1826 he was employed by Messrs. Rennie to make surveys for a line from Nine Elms, Vauxhall, Dorking and Shoreham, to Brighton; and in 1834 he escorted M. Thiers over the railways which had been built under his superintendence. The great French Minister's dictum was, "I do not think railways are suited for France." In England, in Ireland, on the Continent, and in America, Mr. Vignoles took a prominent part in the carrying out of great railway and other engineering works. Probably one of his greatest works was the magnificent suspension bridge over the Dnieper at Kieff, commenced in 1848 and finished in 1853, at a cost of 432,000*l.* A fine model of this is now in the Crystal Palace.

Mr. Vignoles became a member of the Institution of Civil Engineers in 1827, and was elected President in 1870, when he gave a very able address on the progress of engineering. In 1842 he gave a series of remarkable lectures as Professor of Civil Engineering at London University College. In 1855 he was elected a Fellow of the Royal Society; he was also a Fellow of the Royal Astronomical Society, and was for long a regular attendant at its meetings. The Eclipse party of 1860 was to a great extent indebted to him for all the local arrangements, and its success was mainly due to his exertions. He was also Honorary Treasurer of the Expedition of 1870, was on board the *Psyche* when she struck, and was afterwards indefatigable in aiding the necessary arrangements. In the early part of its career he took an active part in the meetings of the British Association, contributing several papers to the Mechanical Section.

As might be expected, Mr. Vignoles was a man of great energy and strong physical constitution. On the Thursday before his death he attended the annual inspection, in his capacity of Lieutenant-Colonel, of the Engineers and Railway Volunteer Staff Corps. On the Saturday following he was struck with paralysis, and remained unconscious till his death on the following Wednesday. He was buried yesterday at the Brompton Cemetery.

THE GERMAN COMMISSION ON ARCTIC EXPLORATION

FURTHER details concerning the work of this Commission appear in a recent number of the *Karlsruher Zeitung*.

The Commission cannot recommend another Arctic expedition. The task of special geographical discovery, to whose solution previous expeditions have contributed, must, since the polar regions have been opened up at many points, give place to the task of exploring in detail the region of which we now have a general knowledge, and on the results thus attained to construct a sure basis for wider researches. "Without such an established basis, every new Arctic expedition might, according to the circumstances, accomplish more or less good results, but for this a considerable expenditure of public means would be the less advisable, that we may have a sure expectation, by following a different course from that hitherto pursued, of accomplishing, more slowly perhaps, but all the more surely, the exploration of the Arctic zone, and at the same time solve very important problems in science."

The Commission unanimously agree that the exploration of the Arctic region should be undertaken. The last part of the Report, without pretending to be complete, discusses very important questions in all departments of science, the solution of which is to be obtained by Arctic exploration. The majority of meteorological and hydrographic problems, many questions in the regions of terrestrial magnetism and physical astronomy, a number of questions in the department of natural science, in other words, the discovery of the laws of periodical phenomena and of the variations from these laws, cannot be accomplished by an Arctic expedition of the kind hitherto sent out. Such an expedition cannot remain for any length of time at a number of points, and can therefore furnish observations bearing only on time and place, which do not in the least enable us to conclude what would be the condition at another time.

It is otherwise with those scientific problems in which the establishment of facts is of importance, as in the majority of problems in natural history, and in many of the other regions of natural science and geography. For such problems an expedition of the usual kind would accomplish very valuable results. For the solution of other problems the establishment of observing stations is desirable, from which, through as long a period as possible, observations of periodical phenomena should be undertaken. But in order to be able to generalise the results, corresponding observations should be made from time to time at intermediate stations and in regions lying in the neighbourhood. A German expedition would thus erect observing stations on particular points, and then would make such arrangements that, according to the special circumstances of the stations, or to accomplish special scientific objects, exploring journeys could be made from the stations as a basis, by land and water, in sledges, ships, or boats. This combined system of fixed stations and exploring journeys would give us at least the prospect, by the minute exploration of any particular region in which it might be employed, of enriching our knowledge with a plentiful supply of facts.

The problems indicated by the Commission for Arctic exploration can only be fully solved by means of a connected system of stations and exploring journeys in the Arctic region, and thus the way be opened up to the hitherto entirely unexplored portion. Explorations must thus be carried on by the three great water approaches,

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